

Chestnut

THE JOURNAL OF THE AMERICAN CHESTNUT FOUNDATION



A BENEFIT
TO MEMBERS



THE
AMERICAN
CHESTNUT
FOUNDATION®

Chestnut

THE JOURNAL OF THE AMERICAN CHESTNUT FOUNDATION

1

PRESIDENT'S MESSAGE
from Lisa Thomson

3

NEWS FROM TACF
Those Pesky Voles
Conservation Area Dedicated
For the Love of Chestnuts
Early Successional Forests

11

NEWS FROM TACF
Chestnut Planting
on Cape Cod
Planting Pure
American Chestnuts
The Merry One

17

2017 ANNUAL MEETING
HIGHLIGHTS

22

THE SCIENCE
Accelerating Blight
Resistance Screening
NE-1333 Meeting
The American Chestnut
Tree Returns

32

PIONEERS
Dennis Fulbright

35

REFLECTIONS
1891 Chestnut Circular

36

RECIPE
Roasted Butternut Squash
and Chestnut Soup

37

IN MEMORY AND
IN HONOR

A BENEFIT
TO MEMBERS



THE
AMERICAN
CHESTNUT
FOUNDATION





Lisa Thomson

President and CEO

DEAR CHESTNUT ENTHUSIASTS,

Welcome to 2018 and a new year of hopes and dreams to further the mission of TACF. The passion and fervor of our supporters never ceases to amaze me, as our mission spans generations of time.

This passion was evident at our rousing fall meeting in Portland, Maine. What a gathering it was! A group boated to an island near Portland for a lobster roast; we enjoyed spectacular keynote speakers and workshop leaders; and participated in a chestnut orchard tour on the final day of the meeting that highlighted a large surviving American chestnut. I loved seeing the rekindling of friendships, the exchange of ideas, and the young scholars competing for the best scientific posters. We are grateful for the stalwart Maine Chapter volunteers who were invaluable friends and tireless workers to ensure the meeting went smoothly.

We are already gearing up for our 2018 fall meeting at the other end of the chestnut range in Huntsville, Alabama. Please mark your calendars for October 26-28, 2018 and plan to enjoy some southern hospitality. The Alabama Chapter is very excited to host us!

Meanwhile, science marches on. We have been roguing, inoculating, analyzing data, and planning our 2018 plantings. Meadowview Research Farm staff are busy building our greenhouse, thanks to your generosity. We are working closely with State University of New York College of Environmental Science and Forestry (SUNY-ESF) to ensure the transgenic tree will navigate through the complicated (and expensive) federal regulatory process and will be available for release in the near future. It is a non-stop effort to work all pathways towards the goal of restoring the American chestnut.

We are so glad you are with us in this effort. Many of you donated to our year-end appeal and I am so grateful for your generosity and loyalty. Like myself, many of you have TACF in your estate plans; if you have not notified us of your intentions, we would love to thank you and make you a member of the Chestnut Society. Here is a challenge: please recruit five new members in 2018 in your circle of friends and associates. If all of us did this, our membership rolls would increase exponentially, translating into new and increased resources to speed up our restoration efforts.

Happy New Year!

Lisa Thomson, President and CEO
The American Chestnut Foundation



Follow me on Twitter (@MadameChestnut).

Snowy Bur

This wintery photo was taken at Meadowview Research Farms several years ago. It recently reemerged and we thought it would make a nice cover for the magazine.



THE
AMERICAN
CHESTNUT
FOUNDATION®

WHAT WE DO

The mission of The American Chestnut Foundation is to return the iconic American chestnut to its native range.

CONTACT US

chestnut@acf.org
acf.org
facebook.com/americanchestnut
twitter/chestnut1904

TACF National Office
50 N. Merrimon Avenue
Suite 115
Asheville, NC 28804
(828) 281-0047

Meadowview Research Farms
29010 Hawthorne Drive
Meadowview, VA 24361-3349
(276) 944-4631

Mid-Atlantic Regional Office
The American Chestnut
Foundation
900 Natural Resources Drive
Charlottesville, VA 22903
(828) 281-0047

New England Regional Office
Northern Research Station
Forest Service, U.S.
Department of Agriculture
705 Spear Street
South Burlington, VT 05403
(802) 999-8706

North Central Regional Office
Pennsylvania State University
206 Forest Resources Lab
University Park, PA 16802
(814) 863-7192

Southern Regional Office
50 N. Merrimon Avenue
Suite 115
Asheville, NC 28804
(434) 906-9312

OFFICERS

CHAIRMAN:
Michael D. Doochin, TN
**SCIENCE AND
TECHNOLOGY CHAIR :**
Dr. Brian C. McCarthy, OH
**PROMOTION AND
OUTREACH CHAIR :**
Catherine Mayes, VA
SECRETARY:
Barbara Tormoehlen, IN
TREASURER:
Steve Barilovits III, NC
SENIOR SCIENCE ADVISOR:
Dr. Kim Steiner, PA
LEGAL COUNSEL:
Donald C. Willeke, Esq., MN
PRESIDENT & CEO:
Lisa Thomson

BOARD OF DIRECTORS

Yurij Bihun, VT/NH
Dr. Hill Craddock, TN
William Jay Cude, TN
Dr. Carolyn Howes Keiffer, OH
Jack LaMonica, VA
Lewis Lobdell, PA
Kathleen Marmet, VA
Dr. Gregory Miller, OH
David W. Morris, AL
Allen Nichols, NY
Z. Cartter Patten, TN
Dr. Jean Romero-Severson, IN
Bradford Stanback, NC
Bruce Wakeland, IN
John Wenderoth, DE

EMERITUS MEMBERS

Essie Burnworth, (posthumously)
Dr. Gary Carver
Herbert F. Darling, Jr.
Hugh Irwin
Dr. William G. Lord
Dr. William L. MacDonald
Glen Rea
Rufin Van Bossuyt
Richard Will

CHIEF SCIENTIST EMERITUS

Dr. Frederick V. Hebard

HONORARY DIRECTORS

President Jimmy Carter
Dr. Richard A. Jaynes
Mrs. Mary Belle Price
Dr. Peter H. Raven
Dr. Philip A. Rutter

STAFF

ASHEVILLE

Lisa Thomson, President & CEO
Betsy Gamber,
Vice President of Operations
Judy Antaramian,
Membership Coordinator
Samantha Bowers, Grants Manager
Cherin Marmon-Saxe,
Executive Coordinator
Heather Nelson, Controller
David Kaufman-Moore, Donor
Relations Manager
Jules Smith, *Chestnut* Editor
and Social Media Specialist

Dr. Jared Westbrook,
Director of Science
Shana Zimnoch,
Gifts and Records Specialist

MEADOWVIEW

Eric Jenkins,
Technical Coordinator
Dan McKinnon,
Seed Orchard Supervisor
Jim Tolton,
Farm Maintenance Technician
Emily Watson,
Research Technician
Brandon Yañez,
Research Technician

REGIONAL SCIENCE COORDINATORS

Sara Fitzsimmons,
North Central, and
Director of Restoration
Michael French,
Forester
Kendra Collins,
New England
Ben Jarrett,
Southern
Thomas Saielli,
Mid-Atlantic

EDITORIAL

DESIGN & LAYOUT:
Lisa Alford
CONTRIBUTING AUTHORS:
Emily Nowels

At The American Chestnut Foundation, we strive for accuracy in all of our publications. We regret any errors or omissions and appreciate those who bring them to our attention. In the fall 2017 issue of *Chestnut*, we have corrected the following information:

- We mistakenly omitted a quote by VA Chapter member Gail Olson in the "Remembering Stacey Levin" article from the 2017 fall issue of *Chestnut*: "My favorite memory of Stacey has nothing to do with chestnuts but everything to do with her courage that I greatly admired. When Stacey knew her hair would be falling out from chemo, she showed up at our home with it cut in a Mohawk and dyed blue. I loved that about her and will miss her energy, her spirit and her humor. I'm reminded of a quote: "The Devil whispered, "You can't withstand the storm." The warrior replied "I AM the storm." I remember Stacey as a warrior." We apologize for this omission.

Those Pesky Voles

WHAT THEY DO TO CHESTNUT TREES AND HOW TO FIGHT THEM

By Paul Sisco, Carolinas Chapter and Sara Fitzsimmons, Director of Restoration



Ever had a small chestnut tree die for no apparent reason; tug on it, and have it come right up from the ground missing its root system?

Or see a tree leaning?

Or notice that bark is missing around the base of one or more of your trees?

If so, you've probably got a vole problem.

What are voles? For one thing, they are not moles. Moles are small furry critters with pointed noses that eat insects and earthworms. Moles are meat-eaters. Voles are small furry critters with blunt noses that eat plants, including grass, roots, and (unfortunately) chestnut trees. Voles are vegetarians.

In the eastern US, we are usually dealing with one of two vole species, the Meadow Vole (*Microtus pennsylvanicus* [Ord]) or the Pine Vole (*Microtus pinetorum* [LeConte]). Meadow voles are larger with longer tails and big eyes, while pine voles are smaller with short tails and very small eyes. Meadow voles are poor tunnelers. They often follow mole tunnels along the soil surface. So they mostly do damage by eating bark just above the soil surface. Pine voles are very good tunnelers, and they live in burrows up to a foot deep. Thus their small eyes. They can be very destructive to tree roots.

Voles are prolific. They put rabbits to shame. Since they multiply quickly with several generations per year, it is important to battle them proactively. The first way to potentially prevent vole damage is with good vegetation control. Voles generally prefer to stay hidden under lots of grass. If you remove the grass via herbicide sprays or keep the grass very, very short, this leaves many voles visible to birds of prey and other predators. Another method is to exclude them from the tree via protective cages or tubes.

Unfortunately, these methods are not foolproof. Pine voles can tunnel under barriers to the depth of a foot. Some vegetation control methods such as mulch or landscape fabric exacerbate vole problems by giving them a place to hide. Even when appropriate cultural controls are followed, voles can seek cover in the winter under blankets of snow, and chestnut orchardists often discover extreme vole damage after heavy

snowfall years. When all else fails, the best method is toxic vengeance.

There are several toxicants available for vole control, but use them wisely and be sure to check with your local extension agent about their use. These chemicals are not specific to voles and can lead to widespread collateral damage. For that reason, the best method for applying these toxicants is in bait stations where only burrowing creatures are likely to go and then stay. For about \$5 a piece, one can fashion a t-shaped bait station out of PVC pipe. By placing several of these near vole runs, one is likely to have the voles enter the trap, take the lethal bait, and stay underground to perish.

Voles often do their worst damage from late fall through early spring. Therefore, bait stations should be placed in the fall on/near existing vole runs so they may be effective through the winter months.



Pine vole (right, with short tail) and meadow vole (left, with long tail). Photo by Alan T. Eaton.



Close-up view of a vole bait station in an orchard located in Schooley's Mountain, NJ. Photo by Kelli Kovacevic.



Vole bait station in an orchard at The Arboretum at Penn State. Photo by Stephen Hoy.

For helpful resources on how to control a vole problem, visit Penn State's College of Agricultural Sciences website: <http://ecosystems.psu.edu/research/chestnut/breeding/pests/other-animals/voles>

Conservation Area Dedicated

TO LONG-TIME TACF MEMBERS BLAIR AND MARY CARBAUGH

By Sara Fern Fitzsimmons, Director of Restoration



❶ Sara and Blair take a selfie with signage at the newly dedicated "Carbaugh Conservation Area."

❷ Attendees to the dedication of the "Carbaugh Conservation Area" mingle, review educational signage, and walk among the chestnut trees.

"Have you ever heard of The American Chestnut Foundation?" In 2011, that was the question posed by Cindy Dunn to Dave Crowl, thereby starting a larger collaborative which helped transform 6,500 acres of abandoned minelands into a unique marriage of recreation and conservation in Northumberland County, PA called AOAA, the Anthracite Outdoor Adventure Area. Cindy Dunn is the current Secretary of Pennsylvania's Department of Conservation and Natural Resources (PA DCNR). Dave Crowl is the Public Director of Northumberland County's Conservation District, and an authority member of AOAA. AOAA is a combination of a natural resource conservation area and a series of trails designed for motorized and non-motorized vehicular use and recreation.

As part of the conservation work at AOAA, many partners and volunteers came together to remove illegal dumps from the site, remediate mining and other hazards, control acid mine drainage and, of course, plant chestnut trees. When Cindy asked Dave if he had ever heard of TACF, he had! Dr. Blair Carbaugh and his wife

Mary live nearby AOAA and have long been involved in many conservation efforts, including work with TACF. Blair and Mary do as much American chestnut outreach and planting as they can. So when Cindy asked Dave that question, he knew where to turn.

Blair and Mary Carbaugh have been members of TACF since 1996. Since then, they have planted over 1,000 chestnuts on their property as part of TACF's research work, helped coordinate planting on at least 12 other sites, and led efforts to put American Chestnut Learning Boxes in many local schools. When Dave approached Blair and Mary about AOAA in 2011, Blair suggested planting a few chestnut trees on the abandoned mineland to first see how they would survive.

As remediation on the site progressed and AOAA became a true possibility, cooperators pulled together to fund the fencing of two acres across three different sites. In 2014, the PA/NJ Chapter of TACF, along with the Carbaughs and several local volunteers, worked for several days to install hundreds of chestnuts into those fenced areas. That same year, AOAA was officially open for business.

Three years later, on November 16, 2017, many friends and collaborators on the AOAA project including Cindy Dunn, Dave Crowl, PA State Senator John Gordner and TACF's Director of Restoration, Sara Fern Fitzsimmons, gathered at the site to surprise the Carbaughs with a special dedication. Mary couldn't make the program that day, but when Dave opened the door to let in Blair, he was met with a round of appreciative applause. Speakers gave a history of the project and collaboration made possible through Blair's efforts and, at the end of the program, the group drove out to one of the fenced chestnut areas to officially name the location the "Carbaugh Conservation Area."

AOAA is a fascinating example of what can happen when dozens of partners come together with the efforts of hundreds of hard-working staff and volunteers to take what was a large and dangerous piece of property and turn it into a valuable community resource. Blair and Mary have certainly worked to create a better place for Northumberland County, and an ongoing legacy for conservation across the state of Pennsylvania.



Four of 16 potentially blight-resistant American chestnut seedlings that Madeleine Lombard germinated to await planting at the Bridge Street Cemetery. Photo by Steve Jones.



For the Love of Chestnuts

By Lilly Lombard

One of the earliest colonial graveyards in America, the 10-acre Bridge Street Cemetery in downtown Northampton, MA holds stories of living, dying, and remembering.

Some of its stories are deeply personal to my teen daughter, Madeleine, since our family's first home in Northampton abutted the 17th century cemetery when she was just a tot. Ask what she remembers of living near the cemetery from age 1 to 4, and Madeleine will recall the low-hanging branch of a cedar tree that we gripped to swing over the cemetery fence from our yard. She will describe the grand copper beech with gnarled elephant toes pressing against weathered gravestones, and the delicate pine seedlings that our neighbor, Larry, discreetly planted in decaying stumps of the cemetery's old pine trees – his clever attempt to sprout a new generation of trees without disturbing ancient graves (it worked).

Madeleine is filled with new purpose and passion. “I helped my little town revive the great American chestnut tree.”



Madeleine prepares to move the seedlings from the “nursery” in her yard to the Bridge Street Cemetery. Photo by Lilly Lombard.



Madeleine as a toddler (left) sitting with her friends against a gravestone in the cemetery. Madeleine is clutching fruit she foraged from a nearby tree, capturing her early love of all things plant. Photo by Lilly Lombard.



Each chestnut seedling planted in Northampton was protected from nibbling animals, using gutter tubing and hardware cloth. Photo by Steve Jones.

Above all, she will recall her beloved tulip tree with solid, plumb trunk, cheerful blossoms, and perfect habit, under which she picnicked and sang with her babysitter Paige, and where she witnessed her neighbors exchanging wedding vows. In her toddler mind, the trees of the Bridge Street Cemetery were living totems of the dead, and faithful friends to the living.

It was fitting therefore that, this fall, Madeleine, Paige, and I returned to the Cemetery – the first reunion there in 12 years – to plant eight American chestnut seedlings. We were joined by our friend Steve, who, as a member of The American Chestnut Foundation (TACF), procured 16 potentially blight-resistant nuts from TACF, entrusted Madeleine

to germinate them, and asked me, as chair of Northampton’s Public Shade Tree Commission, to help secure good homes for them. “How about the Bridge Street Cemetery?” I asked Steve and Madeleine as we sat at my kitchen table in mid-summer. Full sun. Excellent soil. Close to downtown, but well protected. Hallowed, historic grounds. “I’ll bet folks buried in the cemetery once knew the chestnut tree well.”

When the Bridge Street Cemetery was established in 1663, American chestnut trees dominated the forested landscape of the Northeast, and the Nonotuck people and native animals of our region relied on chestnuts for diet and habitat. European settlers quickly recognized the high quality lumber of American

chestnut trees and harvested them aggressively. Many of the 18th and 19th century tobacco barns still standing in our valley were built of American chestnut. Given their famous rot resistance, Madeleine and I wondered if some of the coffins buried at the Bridge Street Cemetery were made from chestnut wood.

On a Wednesday afternoon, Madeleine and I arrived at the cemetery with extra time to stroll through our old “backyard” before the scheduled planting. “The tulip tree!” Madeleine gasped, as we walked into its view. “Still gorgeous. Maybe our chestnut trees will become as grand as that tree. Maybe someone will picnic under them or get married.” Glancing to our beloved copper beech, however, our smiles dissolved.



Madeleine displays the lengthy taproot of a chestnut seedling before planting it in the historic Bridge Street Cemetery. Photo by Steve Jones.

“Fungal disease,” Madeleine instantly recognized, observing extensive branch dieback and withered leaves. We always knew that this tree was susceptible; another grand European beech in the cemetery had succumbed 12 years earlier to the illness.

As we quickly inventoried other favorite trees, Northampton’s Tree Warden, Rich, drove up in his truck. Serving many years as Northampton’s Director of Cemeteries, Rich knows these grounds and trees even better than us. In fact, my first encounter with Rich 15 years ago involved a heated disagreement regarding trees while Rich shoveled a grave pit in the newer section of the cemetery. He chuckles at the memory. “I thought to myself, ‘Who is this woman? By the end of this conversation, one of us is going to end up in this hole.’”

Now more harmonious partners in tree advocacy (thankfully), Rich and I gathered tools from his truck, divided tasks among our group, and worked methodically for the next three hours. We carefully set the taproot of each seedling vertically in a bed of sandy loam, then protected the young stem from nibbling predators with a cage of hardware cloth. Dig, pat, snip, hammer, screw, water, repeat. The rhythm and speed of our work juxtaposed against the internal clock of our little hardwood tree that measures time in centuries, not hours.

As afternoon shifted to dusk and each tree settled into its permanent home, Madeleine and I reflected on the fate of the American chestnut tree and absorbed the historic significance of our planting. When the chestnut blight swept through in the early 1900s, the economic loss of food and lumber alone must have been devastating, never mind the disruption to the ecosystem that results when a keystone species goes extinct.

And here we were, bringing it back. “Mom, these trees could be grandparents to a new generation of American chestnuts.”

With a total of 16 young American chestnut trees now planted at three locations in Northampton thanks to Steve’s vision, Madeleine’s seed propagation, Rich’s leadership, and teams of volunteers like Paige, Madeleine is filled with new purpose and passion. “I helped my little town revive the great American chestnut tree.”

The following week, my plant-whispering teenager visited a local classroom of first graders to share her love of trees. Recalling her tender sensibilities as a child, Madeleine’s plan was simple: Tell a story. Sing a song. Ask them to recall a tree that they love, and invite them to meet her dear friends – old and new – living in the Bridge Street Cemetery.

Golden-winged Warblers, Early Successional Forests and The American Chestnut Tree!

By Clark Beebe, PA/NJ Chapter

Golden-winged warbler populations have been in precipitous decline for decades. A major cause is that our forests have grown up! In many areas by 1900 there was little forest left. It had all been cut for lumber, for firewood and to make charcoal for iron production. But we do have a lot of forests today; for instance, New Jersey, the most densely populated state in the US, is 40% forested!

The problem with today's forests is that they are all roughly the same age. Most of today's forest stands either started from the remains of the forest that had been logged in the late 18th century or from fields abandoned during the 1930s through 1950s as first the depression hit and then farming methods changed. As the new forests matured the young successional aspect of the habitat gave way to more mature stands of fewer but larger and taller trees.

Golden-winged warbler.
Photo by David Kenny.



Also during the past 50 plus years we have worked diligently and increasingly successfully to prevent forest fires. But after a fire new growth creates the desired young successional forest. By eliminating fire we have modified the forest ecosystem.

The problem for the golden-winged warbler, wood thrush, and many other declining species is that they require some of the younger denser forests within a patch of older forest to rear their young. The chicks cannot hide from predators on the open floor of a closed canopy forest. And that forest floor does not provide the insects needed for their diet.

Foresters and wildlife biologists are working together to promote more young successional forests. Often however they are met with public opposition because creating young forests means removing parts of the existing older forests. And that's where problems often arise.

Some people never want to see any tree cut. Loggers are often vilified as demons! The foresters and wildlife professionals are said to have "sold out" to commercial interests!

Fortunately groups like the Audubon Society understand the science and have teamed with private and public

landowners alike to try and educate the public while helping declining species like the golden-winged warbler.

The second problem however is even when you cut the older forest to promote new younger forests, they only stay young for a certain number of years. Then they become too big, too tall and the process has to start over - or, more accurately, continue as an ongoing effort. And this is where the American chestnut comes in.

In 1900, the American chestnut was the dominant species throughout the Appalachian Mountains. One out of four trees was an American chestnut! In New Jersey and Pennsylvania, they would get up to six feet in diameter. Farther south in the Carolinas and Tennessee, they got up to 15' in diameter! Then a fungus with airborne spores arrived and they were essentially wiped out.

However, they are still with us because the fungus (called the chestnut blight) only kills the top of the tree; the part above ground. The roots live on and send up new sprouts which typically live five or ten years before they too contract the blight and die back.

And therein lies the trick for creating "almost permanent" young successional forest habitat. Plant

pure American chestnuts. They will grow 10, 15, or even 20 feet and then get the blight and die back. But a new shoot will sprout and it will start all over again. The blight, in essence, has taken the roll of fire by creating the new young growth - the "almost permanent" young successional forest. Even the dead standing rot-resistant stems provide long-lasting dense structure and cover for habitat. A WIN for wildlife; a WIN for foresters and biologists; and a WIN for forest landowners!

However, as always, there is a catch. "Almost permanent" is not permanent. The problem is that when the chestnuts die back from the blight, other species that have blown in and grown up with the chestnuts are not affected by the blight. They continue to grow and will outcompete the chestnuts over time.

So, a little periodic maintenance will be necessary to maintain the young successional nature of the planting. Maybe once a decade there will be a need to go in and remove or girdle the outcompeting species. But by doing so, it means the trees will get the sun needed to produce chestnuts, an ongoing benefit to wildlife habitat.



Pure American chestnut planted in an orchard in Rock Springs, PA that has died back from the blight and resprouted, demonstrating "permanent" young successional habitat. Photo by Sara Fitzsimmons.



Wood thrush nest in New Jersey. The lack of understory within a forest, caused by a completely closed forest canopy or heavy deer browse, limits where these birds are able to find suitable nest sites. Photo by Mark Peck.

Chestnut Planting

ON CAPE COD

On a beautiful summer day on Cape Cod, leaders and staff of the Woods Hole Research Center gathered on the Center's 10-acre campus to replace a recently lost maple near the entrance to the principal building with an American chestnut hybrid seedling.

Philip Duffy, the current President and Director of the Center welcomed all. Director Emeritus George M. Woodwell introduced TACF President & CEO, Lisa Thomson, who explained the history of the American chestnut and the hope for restoration of that magnificent tree through new genetic strains resistant to the blight. She explained the destruction of the American strain throughout its once wide range in eastern North America, including Cape Cod, and the importance of reestablishment, if possible, of a new resistant strain viable throughout that once wide range. Woodwell, long familiar with the work, explained the Center's interests in research on forests and mentioned the five seedlings planted earlier on the campus, all still thriving, one more than 12 feet tall. George has been an enthusiastic supporter for years, and this demonstration planting sparked immediate interest and vigorous conversation among staff and friends. He pointed out that this new planting is on that path taken by scientists from around the world who come to the Center on various research projects. The seedling's survival is critical and will be watched around the world. He thanked all and urged a regular return to celebrate the moment as key in rebuilding North American forests!



George Woodwell and Lisa Thomson hold chestnut hybrid seedlings in front of The George M. Woodwell Building, named in honor of George in 2008.



Philip Duffy, president and director of the Woods Hole Research Center, and George Woodwell, director emeritus, work together to plant the chestnut seedling.

PART 2
of a 4-part series
on preserving
American chestnut
genetic diversity in Maine

Planting Pure American Chestnuts

ON WILD AND REMOTE LONG ISLAND, MAINE

By Thomas Klak, TACF Gene Conservation Committee Chair and Matthew Sutherland, Maine Chapter

Among the most rewarding aspects of working on American chestnut restoration are the magical places you experience and the similarly-passionate folks you meet. Such rewards were well illustrated during a two-day excursion in early July 2017 to Long Island, off Acadia National Park's west coast, to install a Germplasm Conservation Orchard (GCO).



Matt and Melissa Sutherland's rustic yet modern cabin maintains Long Island's traditional vernacular of cedar shakes; in the foreground, 100 pure American chestnut seedlings from diverse Maine source trees await their new home. Red generator provides limited power.

Map of Maine with Acadia National Park (l); and map of Acadia with Long Island and Blue Hill (r). (Sources: Google Maps & “Joe’s Guide to Acadia National Park” citrusmilo.com/acadiaguide/maps/joebraun_mainemap1.jpg)



Long Island’s Engaging Geography and History

While there are several “Long Islands” on the east coast, this one lies between the town of Blue Hill and Acadia National Park (see maps). This Long Island is nearly 4,800 acres or about seven square miles in area, and includes 13 miles of coastline. Like most of Maine, Long Island is 90%+ forested, but unlike Maine as a whole, it has no year-round residents. That makes it the largest island on the US east coast without permanent residents. It is also Maine’s largest island without connection to the mainland by bridge or ferry service.

Prior to European settlement, Native Americans spent summers on Long Island. By the 1700s both Native Americans and Europeans occupied different parts of the island. Early European settlement in Maine favored coastal sites and islands for access to essential water transportation. At the height of Long Island’s settlement in the mid- to late-1800s, well over a hundred year-round residents farmed and fished. Settlers were served by stores, a post office, two school districts, a lumber mill, a large boardinghouse, and even a dance hall for inter-island fêtes on Saturdays. The island’s sheep population peaked at around 6,000. In the 1890s about 150 people mined granite at a quarry. By 1920, however, road networks connecting Maine’s interior created greater economic opportunities and encouraged islanders to relocate on the mainland. Virtually all of the year-round Long Island residents had left. Today foundation stones and a cemetery help recall the island’s vibrant settlement history and hold many archaeological opportunities.

Long Island’s flora and fauna rejuvenated over the last century of sparse human activity. Because Long Island lies between Acadia National Park and a

coastal region experiencing substantial development pressure, the National Park Service targeted it for permanent protection. In 1995 the Park Service paid a landowner to protect 95% of the island through conservation easement. Long Island is thereby part of the more than 12,000 permanently-protected acres around Acadia. Virtually all of this protected (yet still privately-held) land is on islands in the buffer surrounding Acadia, the northeast’s only national park.

Planting a Pure American Chestnut Germplasm Conservation Orchard on Long Island

About five percent of Long Island acreage remains outside of the National Park easement. This includes twelve seasonal camps and a few other land parcels. One of those camps is on 15.5 acres near the island’s high point and is owned by Matt and Melissa Sutherland. Matt graduated from the University of Maine-Orono and through that connection contacted Dr. Brian Roth, ME-TACF Chapter board member. Matt sought a way to connect his positive feelings about UMaine, the environment, and the American chestnut. Discussions led to a plan to locate one of the four GCOs to be installed in 2017 on Matt’s land.

In early July 2017, a team of six chestnut enthusiasts convened at the South Blue Hill wharf. The team included four Maine Chapter board members, a TACF student intern from the University of Maine-Orono, and Matt Sutherland (see team photos). They boarded Matt’s boat and motored one mile off shore to Long Island in Blue Hill Bay. Also on board were all the components needed to install a GCO. These included one hundred pure American chestnut seedlings grown



Completing the installation of a solar-powered electric fence (l to r: Thomas Klak, Brian Roth, Amanda Barbieri, Larry Totten and Al Faust).



Brian Roth pries a boulder away from the ATV trail while Al Faust, James Wootten and Simeon Allen assist.



Large items require an ATV to move between the boat dock and the interior parcel; Larry Totten, Matt Sutherland and Al Faust pack gear in front of the completed Germplasm Conservation Orchard.



Al Faust anchors the landscape fabric, while Amanda Barbieri cuts bayberry roots to make way for the seedlings and Larry Totten augers planting holes.

by University of New England students under Dr. Klak's direction, landscaping fabric, augers, seedling collars, an electric fence, a solar/battery unit, and provisions.

Like many experiences with TACF volunteering, the next two days were exhausting but greatly satisfying. Matt's land is about a third of a mile from the dock in the island's northern interior. All inputs must be carried or moved by ATV from dock to his land. Matt selected a site for the GCO that was formerly an agricultural field and has southern exposure. He and his neighbor bush-hogged the mostly bayberry vegetation. Tom laid out the rows of landscape fabric and team members cut holes for the chestnuts. Amanda cut through the dense bayberry root system with loppers to make room for the seedlings. Larry followed by opening planting holes with a five-inch auger. Everyone helped to plant seedlings, secure the landscape fabric and the collars, and install the electric fence and solar power unit. We watered thoroughly from Matt's cistern knowing that, after we left, the seedlings would be subject to the vicissitudes of rainfall. Matt's November 2017 check-in on the GCO revealed about 75% seedling survival rate which, after another summer drought, we judge a success.

Next Steps

Although Long Island is within the northern end of the American chestnut's native range, we know of no wild chestnut trees on the island. A more thorough search of

the island's vast acreage and rugged terrain is warranted. We hope that the island's relative isolation from the fungal blight will offer additional years to the pure American chestnut seedlings and the genetic diversity they embody.

To further the chestnut conservation effort on wild and wonderful Long Island, the team visited with another Long Island landowner and emerging American chestnut enthusiast, Dave Florian. His seasonal camp sits near the southern end of Long Island. Dave and the team's site assessment arrived at an ideal field for another GCO featuring pure American seedlings from different source trees to be planted in late May 2018.

As this story illustrates, volunteering for The American Chestnut Foundation offers marvelous opportunities to commune with nature and with other folks deeply committed to restoring this keystone species. Please contact your local state chapter to get involved!

REFERENCES:

- Hutchinson, Alan E. 1992. "An ecological assessment of Long Island in Blue Hill, Maine" A Report to the Maine Coast Heritage Trust [<https://irmaservices.nps.gov/>]
- National Park Service, Acadia National Park. 2015. "Land Resources" [https://www.nps.gov/acad/learn/management/rm_landresources.htm]
- Sawyer, Rick "Long Island: The Forgotten Community" The Maine Memory Network [<http://bluehill.mainememory.net/page/1807/display%3Fpage=1.html>]

The Merry One

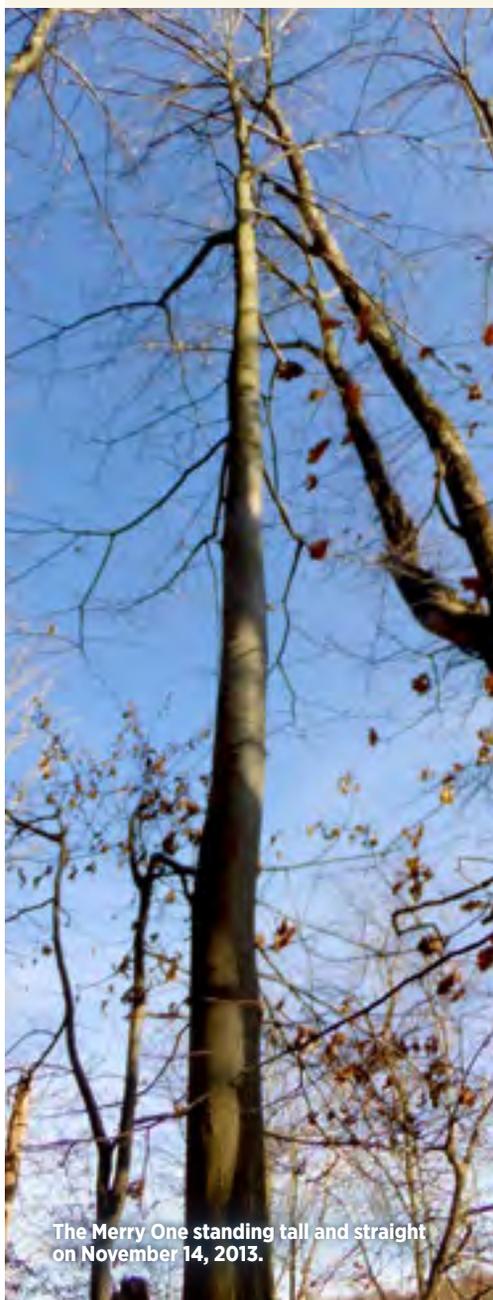
By Mike Manes, PA/NJ Chapter

Our story begins on November 4, 2011. I was with my wife, Kieu, and we were participating in one of our favorite activities, hiking. At the time, we were hiking the Perimeter Trail at Merrill Creek Reservoir in New Jersey.

A number of recently fallen American chestnut leaves were observed on the trail and in the surrounding area. We knew that an American chestnut existed, so we looked. The most likely tree was about four feet off the trail on our left (we were hiking counter clockwise). The tree's circumference was exactly 39 inches and calculated diameter was 12.4 inches. While examining the tree, we saw no visible signs of chestnut blight as it stood tall and straight in the woods with no sprouts. I had difficulty believing this was an

American chestnut since it was so much larger and healthier than any we had seen in the area before, but I was hopeful. We made the decision to come back and check on it again the following spring when it had foliage.

Upon our return in May of 2012, we felt even more confident that it might very well be an American chestnut. We decided to name it "The Merry One." During this hike, we noticed two small chestnut trees within 200 yards of The Merry One that appeared to have the blight, so we were grateful to see this tree still standing tall and strong.



The Merry One standing tall and straight on November 14, 2013.

DATE	CIRCUMFERENCE in Inches (Fraction)	CIRCUMFERENCE in Inches (Decimal)	RADIUS in Inches (Decimal)
11/4/2011	39	39.0000	12.41
5/4/2012	39 1/4	39.1500	12.46
5/10/2013	41 1/8	41.1250	13.09
5/17/2014	43 1/4	43.2500	13.77
11/4/2015	46 7/16	46.4375	14.78
11/3/2016	47 5/8	47.6250	15.16
11/15/2017	49 7/8	49.8750	15.88

In 2013, TACF's Director of Restoration, Sara Fitzsimmons, examined leaf and twig samples of the tree and determined that it was indeed a pure American chestnut. We have measured and recorded the circumference on a number of occasions since its discovery (see table). Our most recent visit was on November 15, 2017 - it is almost 50 inches in circumference now and shows no signs of blight.

When we first found The Merry One, it was under a canopy, mostly covered by a large white oak. The white oak is slowly dying, allowing the sun to shine on parts of our chestnut. The first couple of years there were no burs on the ground near this tree, but over the last three years, burs have been present, though in very limited numbers. Because of The Merry One, Merrill Creek has become one of our favorite hiking spots, and we plan to continue following the growth and progress of this special tree.



Kieu Manes (wife of the author) holding a chestnut leaf and standing by The Merry One on May 4, 2012.

The Benefits of Monthly Giving

Becoming a Sustaining Chestnut Member with The American Chestnut Foundation is a budget-friendly way to increase your giving power and support our mission of returning the iconic American chestnut to its native range.

Through a secure transaction, your monthly gift gives you the benefits of uninterrupted membership to TACF, including our award-winning magazine, *Chestnut* and membership in your state's chapter.

Sustained giving is an eco-friendly option. With fewer renewal mailings, it is a green way to contribute!

With your sustained gift, we are able to provide funding for these and other projects:

Traditional breeding with hybridization

Genomic selection

Biotechnology

Regional breeding with American chestnut germplasm conservation

Major pests and diseases affecting forest ecosystems, such as *Phytophthora* root rot

Silvicultural and reforestation projects

Please visit our monthly donation page at: acf.org/store/donate-monthly#your-donation.

Once there, choose the amount you would like to give or choose "other" and write in your own amount. This amount will be automatically charged to your credit card on the same day every month. You can make changes or cancel any time by calling (828) 281-0047.



THE
AMERICAN
CHESTNUT
FOUNDATION®

**Our vision is a robust eastern forest returned to its splendor.
Won't you join us in this bold mission?**

Annual Meeting Restoration Tour

During the fall meeting in Portland, Maine, donors, members, distinguished guests and TACF staff were treated to a setting of spectacular sunsets, seafood, and ocean views that New England is famous for. The meeting finale was a chestnut restoration tour of three orchards in parts of Southern Maine, led by Dr. Brian Roth, ME-TACF Science Chair and Acting Director of the Cooperative Forestry Research Unit at the University of Maine's School of Forest Resources.

The tour included stops in Vienna, Readfield, and Winthrop, and highlighted the commitment of TACF and the Maine chapter to restoring the American chestnut tree.

The Vienna stop was at a Maine Woodlot Owners Trust property.

The goal of the plantings at this orchard is to study cold adaptation and blight resistance in a forested setting.

The second stop in the town of Readfield is within walking distance of the historic town hall and Factory Square where one of the largest surviving American chestnut trees live. The tree measures 80 feet in height and some 22 inches in diameter.

Winthrop was the final stop on this amazing tour. Participants visited a seed orchard at another Maine Woodlot Owners Trust property, part of the Georgia Wiesendanger Wildlife Protection Area. Discussions here focused on the breeding program and tools that are used to select the most resistant trees.

Thanks to all who made this informative and thought-provoking tour a huge success!



Mid-Atlantic Regional Science Coordinator, Tom Saielli, speaks to the group about cold tolerance and blight resistance during the first stop of the tour in Vienna.



Speaking to the group in Winthrop, Dr. Jared Westbrook discusses the process of selecting the most blight-resistant trees.



Tour group poses under large surviving chestnut tree.

Nina Pearlmutter of the Maine Chapter won the handcrafted chestnut violin, and was thrilled when she heard the news. She told TACF that she used to play the violin and has made plans to pick it up again. The raffle drawing was held at the Dinner and Awards Program.



Dr. Paul Schaberg, Adjunct Associate Professor at the Rubenstein School of Environment and Natural Resources, The University of Vermont, talks to attendees about "Long-term Results from American Chestnut Silviculture and Genetics Research Planting on the Green Mountain National Forest."

THOMAS L. WOLTZ

Keynote Speaker



The American Chestnut Foundation was delighted to host an outstanding keynote speaker at the fall annual meeting in Portland, Maine. Renowned landscape architect Thomas Woltz of Nelson, Byrd and Woltz, gave an inspiring presentation about two of his large-scale projects that incorporate ecological restoration and species preservation to a crowd of about 200 TACF members and friends.

Thomas became involved in TACF almost serendipitously. It was during Lisa Thomson's second month on the job, in February 2015, when her longtime family friend, Genevieve "Vevie" Dimmitt called her one afternoon insisting she hear Thomas' presentation at the Asheville Art Museum. Vevie had just spent some time with Thomas in Florida, who had joined her daughter Mallory's cross-Florida expedition for preservation awareness, and sung his praises. As Lisa describes it, "It was the last thing in the world I wanted to do after a long day in the office, still trying to get a handle on my new position. It was also sleeting, and being from Florida, going out on a stormy night to hear a landscape architect speak was not high on my list of evening activities!" But Vevie had never steered her wrong, so she went.

Not quite knowing what to expect, she was pleasantly surprised. "I was on the edge of my seat, especially when Thomas described his project in New Zealand combining the recovery of an ecosystem and the return of species long since extirpated. It was the kind of visionary thinking that I knew fit with TACF's bold mission." In fact, the theme of Thomas' presentation in Portland was audacity. He urged us to keep up the good work of restoration the American chestnut, to try new things and not be afraid to innovate.

Lisa recalled, "After his talk in Asheville, I introduced myself as a mutual friend of Vevie's and started to describe TACF's work. He interjected and said, "Oh I know all about your B3F3s and have been following your work for years!" Thomas also has a project in Nashville, so has spent some time with board chair Michael Doochin and his wife Linda at their home. We are lucky to have Thomas as a positive advocate for our work and are grateful for his friendship and enthusiasm for all things chestnut.

2017 Regional Volunteer Service Award Recipients

TACF's regional leadership recognizes and honors our dedicated and hard-working volunteers. Recipients embody TACF's mission to return the iconic American chestnut to its native range.

The American Chestnut Foundation's 2017 Volunteer Service Awardees include:

Jim Curtis: Mid-Atlantic Region

Jim Curtis is one of the Maryland Chapter's most energetic volunteers. Jim has been an active board member and webmaster for many years, consistently offering sensible and innovative advice. He is steward of our State Highway Administration Backcross Breeding Orchard and is the MD Chapter's liaison to the Carroll County Public Schools, many of which have chestnut orchards on school grounds. Chapter activities, such as orchard cleanups, pollinations, harvests, and public outreach at nature-related events, always benefit from Jim's dynamic presence. He is a hard worker and takes the initiative to get things done.

Dr. Charles Maynard

RECEIVES CHARLES BURNHAM AWARD - THE AMERICAN CHESTNUT FOUNDATION'S HIGHEST HONOR



Dr. Charles A. "Chuck" Maynard, recently retired Professor of Science at the State University of New York College of Forestry and Environmental Science (SUNY-ESF), co-founder and co-director of the American

Chestnut Research and Restoration Project at ESF, and charter member of The American Chestnut Foundation's (TACF) New York State Chapter, was presented with the Dr. Charles Burnham Award, at the Dinner and Awards Program.

The Burnham Award, the highest honor bestowed by TACF, is named after Dr. Charles Burnham, an eminent scientist, co-founder of TACF, and father of the backcross breeding program.

It was particularly fitting that the award was presented to Dr. Maynard by his close colleague and friend, Dr. William A. Powell. Bill Powell had worked together with Chuck Maynard for more than twenty-five years as co-directors of their American Chestnut Research and Restoration Project.

Dr. Maynard pioneered cutting edge biotechnology techniques that advanced the science, and culminated in the successful development of the world's first blight-resistant transgenic American chestnut trees. The

value of Dr. Maynard's scientific achievements in furthering the goal of returning the American chestnut to its native range is widely recognized, and has been integrated into TACF's strategic plan for American chestnut restoration.

Because of his distinguished devotion to the American chestnut and to science, as well as his personal qualities, Chuck has gained the admiration and love of his students, colleagues, and members of TACF's New York Chapter. One hundred years from now, when healthy and large American chestnut trees have been restored to our eastern forests, future generations can thank Chuck's tireless work which helped make that happen.

Eric Evans: New England Region

Ten years after TACF was established, there were only four state chapters. In 1998, following a devastating ice storm in Maine, Eric Evans and Welles Thurber knew this damage could have serious consequences to the 150-200 old growth chestnut trees that were still surviving. They traveled to TACF's headquarters in Burlington, VT to see what could be done to create a Maine Chapter. Though it took nearly 18 months, in October of 1999, Maine became the 5th state chapter of TACF. Since that time, Eric has been an active member of the Maine Chapter, serving as president and now breeding coordinator. Due to Eric's fine work, the Maine program has been and continues to be very successful.

Jack Rogers: Southern Region

Former career Navy pilot, part-time school teacher, and long-time supporter of tree conservation programs, Jack Rogers first became involved with American chestnuts when he planted some BC₃F₃s on his property near Dahlongega, GA some years ago. Despite losing some of them to *Phytophthora* root rot, Jack pressed on, began volunteering with the chapter, and was soon named a GA-TACF board member (he currently serves as secretary). Jack has been involved in numerous aspects of the program, including monitoring wild American chestnuts and assisting with disease resistance trials, harvesting, planting, and orchard maintenance tasks. Jack's friendly demeanor and keen interest in learning all about chestnuts is welcome and appreciated by all who have met him.



Poster Session Awards

By Kendra Collins, New England Regional Science Coordinator

Since 2012, TACF's Annual Meeting has included a poster session that highlights current American chestnut research. Participants include seasoned professionals, as well as current students. The session provides the opportunity for researchers to present their work to their peers and to the general TACF membership. This is a great opportunity for students in particular to gain some experience presenting their work to a supportive audience. The session also allows us to highlight a much broader range of topics and current research than we can with our general session programs alone. At our 2017 Annual Meeting in Portland, ME, seventeen posters were presented by a diverse group of chestnut researchers.

In 2017, we expanded the Poster Session program to include

competitive student poster awards, sponsored by TACF's education committee. All student posters were judged by two members of TACF's research community using a standard rubric, and cash prizes were awarded to those with the two highest scores.

Our runner up, Brett Fredericksen, is a second-year doctoral student at Ohio University working with Dr. David Rosenthal. A native of southern Illinois, Brett completed his B.S. degree in Plant Biology at the University of Minnesota – Twin Cities. Since arriving at Ohio University, Brett has worked with American chestnuts in an effort to determine how the species responds to simulated climate change, and moving forward he hopes to study how environmentally stressful conditions can alter chestnut blight resistance.

Our first-place winner, Jessica Barnes, is in her final year of a doctoral program at North Carolina State University. She is a student in the Department of Forestry and Environmental Resources, and has been a fellow in an NSF IGERT (National Science Foundation, Integrative Graduate Education and Research Traineeship) on Genetic Engineering and Society. Her graduate work has broadly focused on the (proposed) use of biotechnology for biodiversity conservation, especially of forest tree species. Her dissertation is highly interdisciplinary and uses American chestnut restoration as a case for thinking about a number of ecological and political questions that have emerged around the release of engineered or hybrid organisms into wild environments for conservation purposes.

Congratulations to Jessica and Brett, and thanks to all the students who participated in the competition!



Many TACF members and supporters showed up to view the posters and ask participants about their research and findings.



Jessica Barnes, first-place winner from North Carolina State University, talks about her poster with Maine Chapter member, Mark McCollough.



Brett Fredericksen (holding certificate) from Ohio University, was the runner up. He poses with Kendra Collins, his advisor Dr. David Rosenthal, and TACF board member Dr. Hill Craddock.

2017 TACF

Photo Contest Winners

2017 brought another good year of entries for TACF's Photo Contest. We would like to thank everyone who submitted a photograph and encourage your participation in our next contest coming this spring.

The first-place winner of this year's contest is **CAROLYN PUCKETT**, whose photo of a blooming chestnut tree hanging over colorful foliage, won the judges over. Carolyn's photo will appear on an upcoming cover of Chestnut and she will receive a complimentary, one-year membership to TACF. Congratulations, Carolyn!

Second place winner is Nathan Laing.

Third place winner is Kelsey Bonifay.



An American chestnut in bloom, seeking sunlight, drapes itself over flowering terraces. Photo by Carolyn Puckett in Hampstead, MD.



A young tree with blight still reaches for the light. Photo by Nathan Laing in Oneonta, NY.



This young American chestnut stands amidst the giants in the Allegheny National Forest. Photo by Kelsey Bonifay in Burning Well, PA.



Using calipers to measure cankers on the stems of the seedlings.

Accelerating blight resistance screening

WITH SMALL STEM ASSAYS

By Jared Westbrook, Director of Science, and Ben Jarrett, Southern Regional Science Coordinator

Small stem assays are being used to accelerate the process of screening American chestnut backcross progeny for blight resistance to identify and select the most resistant parents.

In the small stem assay (SSA) containerized seedlings are inoculated with *Cryphonectria parasitica*, the fungus that causes chestnut blight. Canker development is then evaluated in the first growing season. Prior to the incorporation of the SSA method, the only method used to evaluate resistance using progeny testing was to plant progeny in orchards and wait at least three years before inoculating the trees with the chestnut blight fungus. Screening for blight resistance using small stem assays potentially reduces the time to screen families from three years in the orchard to one year in a greenhouse. We can also screen more individuals from each family, potentially providing more accurate estimates of the blight resistance of the parent trees. Successful progeny testing with the small stem assay hinges on whether differences in blight resistance between families can be reliably detected at the seedling stage. It also hinges on whether or not the family resistance rankings at the seedling stage are correlated with the resistance rankings of the same families planted in orchards.

In 2017, TACF partnered with the U.S. Forest Service Resistance Screening Center (RSC) in Asheville, NC to screen 68 BC₃F₃ families for blight resistance with small stem assays. The families originated from the open pollination 68 BC₃F₂ mothers by neighboring BC₃F₂ trees in seed orchards at TACF's Meadowview Research Farms. Among the 68 families, we included 13 families that had previously been screened for blight resistance in their third growing season in orchards. The goal of replicating families already tested was to determine if the family averages for canker severity would be correlated in small stem assays and in orchard tests. To test if genetic differences in blight resistance are detectable at the seedling stage, we included resistant Chinese chestnut and susceptible American chestnuts as controls. Forty seeds per family were sowed and randomized in the greenhouse. We inoculated half of the seedlings with a highly pathogenic strain of the blight fungus (Ep155) and the other half of the seedlings with

a weakly pathogenic strain (SG2,3). We measured the length of cankers at 7 weeks, 15 weeks, and 24 weeks post-inoculation. There were two additional goals of the study. The first was to determine the time point that provides the greatest differentiation in blight resistance between families for each strain. The second was to determine if resistance rankings among families are correlated when inoculated with strains of the blight fungus that vary in pathogenicity.

Over the course of 2017, approximately 60 volunteers came out to the Asheville RSC to sow 4500 seeds, inoculate the seedlings, and measure their cankers. Volunteers worked through cold conditions in February to fill containers with potting mix and through the hot and humid days of mid-July to take canker measurements and stem diameters. The experiment was visited by a number of chestnut scientists at the annual NE-1333 meeting in October. All the while, our collaborators at the USFS took on the duties of watering, fertilizing, and

overall maintenance of the seedlings. TACF would like to thank the USFS and Sunny Lucas, USFS RSC manager for the use of their facilities at Bent Creek.

Cankers on the Chinese chestnut seedlings were significantly shorter than those on American chestnut 15 weeks after inoculation with the highly pathogenic strain and 24 weeks after inoculation with the weakly pathogenic strain (**Figure 1**). Heritability, or the proportion of variation in canker lengths on BC₃F₃ trees that was inherited from their BC₃-F₂ mothers, was greatest 15 weeks after inoculation with the highly pathogenic strain and 24 weeks after inoculation with the weakly pathogenic strain. At all times, the heritability of canker lengths tended to be greater for trees inoculated with the highly pathogenic strain v. the weakly pathogenic strain (**Figure 2**). Family canker length averages were correlated when canker lengths 15 weeks after inoculation with the highly pathogenic strain were compared with canker lengths 24 weeks



Undergraduate students from UNC-Wilmington randomize seedlings for small stem assays as part of their Alternative Spring Break.

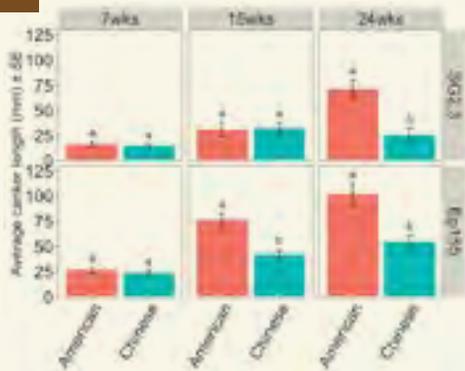


Student volunteers from UNC-Asheville prepare to inoculate seedlings with *Cryphonectria parasitica*.



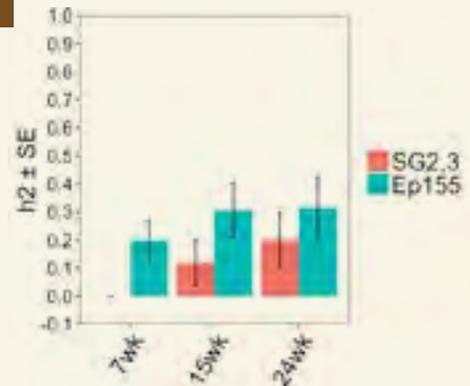
Cankers on American chestnut BC₃F₃ progeny 15 weeks after inoculation with the highly pathogenic Ep155 strain of *Cryphonectria parasitica*.

Figure 1



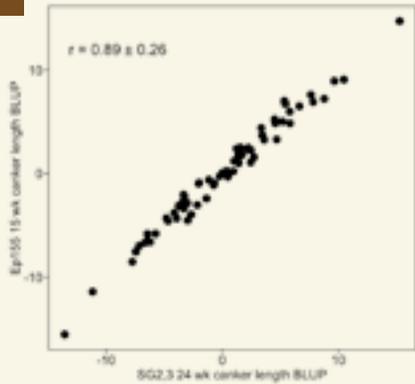
Average canker lengths of resistant Chinese chestnut and susceptible American chestnuts 7, 15, and 24 weeks after inoculation with weakly pathogenic SG2,3 strain and highly pathogenic Ep155 strain of *Cryphonectria parasitica*. Error bars are one standard error of the mean. Different letters indicate significant differences in canker length (Tukey test, $P < 0.05$)

Figure 2



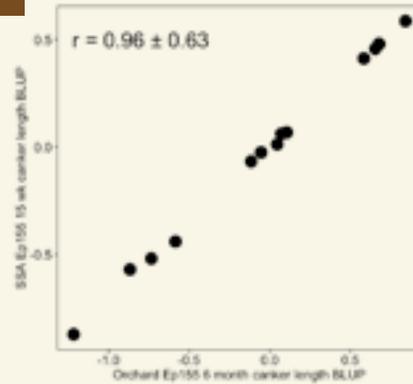
Heritability (± 1 standard error) of canker lengths 7, 15, and 24 weeks after the inoculation of 68 BC_3-F_3 families with a weakly pathogenic strain (SG2,3) and a highly pathogenic strain (Ep155) of *C. parasitica*.

Figure 3



Estimated correlation ($r \pm 1$ standard error) between best linear unbiased predictions (BLUPs) of canker lengths among 68 BC_3-F_3 families 15 weeks after inoculation with the highly pathogenic Ep155 strain and 24 weeks after inoculation with the weakly pathogenic SG2,3 strain.

Figure 4



Estimated correlation ($r \pm 1$ standard error) of best linear unbiased predictions of canker lengths among 13 BC_3-F_3 families in small stem assays and orchard tests.

after inoculation with the weakly pathogenic strain (Figure 3). Among the 13 families previously screened for blight resistance at age three in orchards, canker lengths in the SSA were strongly correlated with canker lengths in the orchards although the precision of the correlation estimate was low (Figure 4). To improve the precision of the orchard v. SSA canker length correlation estimate, we planted additional progeny from all 68 families screened in 2017 SSAs in orchards at Meadowview. We will inoculate these families in the orchard in 2020.

The small stem assay experiment confirmed that genetic differences in blight resistance are detectable at the seedling stage. Based on these

promising results, we will continue screening BC_3F_3 progeny for blight resistance to obtain the results within one growing season. We will also continue to plant progeny from these same families in orchards to compare SSA results and to increase the overall number of individuals screened per family. Our results suggested canker length differences among families are more pronounced when inoculating with a highly pathogenic strain v. a weakly pathogenic strain. Thus in subsequent years we will inoculate all trees with the highly pathogenic strain. For 2018, the SSA experiments will take place in the new TACF greenhouse at the Price Farm in Meadowview, VA. TACF's collaboration with the USFS at the

Resistance Screening Center will continue, but shift focus to screening trees to find families with resistance to *Phytophthora cinnamomi*.

The results from the RSC provide proof-of-concept for TACF's state chapters to use small stem assays to screen progeny from seed orchards. We recommend starting small stem assays after the trees in seed orchards have been inoculated with the blight fungus, and approximately 90% of the parent trees with the most severe cankers have been culled. Small stem assays on the progeny of the remaining trees will help to identify the most resistant parents from these orchards.

UPDATES FROM NE-1333 Meeting

2017

By Ben Jarrett,
Southern Regional Science Coordinator
and Paul Sisco, Carolinas Chapter



Rita Costa, Forestry Research Station, INRB-Portugal; Tatyana Zhebentyayeva, Clemson University; and Paul Sisco at Bent Creek Greenhouse.

On September 14-16, scientists gathered for the 35th annual NE-1333 meeting* at Cataloochee Guest Ranch in Maggie Valley, North Carolina to talk about all things chestnut. From retirees to undergraduates, attendees cozied up in one of the beautiful, rustic cabins of Cataloochee Ranch, gathered around a projector to listen to presentations and give feedback. Scientists in attendance shared their results from last year, and participated in discussion and debates covering a range of topics related to chestnut.

First organized to facilitate research in hypovirulence, the meeting expanded over the years to include all aspects of chestnut science. Participants from as far away as Portugal gave talks on their current research, which spanned the gamut of topics from genetic mapping and transgenic methods to using bees to gather a pure sample of chestnut pollen. Students presented their work in a small, supportive setting, some for the first time. One of the most important aspects of this annual meeting is the opportunity to share results, techniques, and unpublished information and to develop collaborative projects.

When the project began in 1982, there wasn't much hope for chestnut to return as a significant part of North American forests. A lot of progress has been made since then, much of which has been facilitated by participants of these annual meetings. Issues associated with blight/chestnut interactions are complex and multifaceted and emerging pathogens, like *Phytophthora* root rot, and pests, such as the Asian chestnut gall wasp and Asian ambrosia beetle, continue to pose threats to our restoration efforts. However, this multi-state project is indisputably a huge success, as remarkable progress has been made toward understanding and solving problems as they arise.

*NE-1333, entitled "Biological Improvement of Chestnut through Technologies that Address Management of the Species, its Pathogens and Pests", is a regional project supported by Deans of Agriculture Schools in the Eastern US. The chestnut project is the longest surviving project of this type sponsored by the USDA and hundreds of attendees have participated over the years. It has also won two national awards (see photo on page 26) for the quality of its work, the USDA Secretary's Honor Award in 1997 and the 2008 Award for Excellence in Multistate Research, given by the Northeastern Association of State Agriculture Experiment Station Directors. Website: https://www.nimss.org/projects/view/appendix_e_direct/15576

Participants arrived on Thursday for a social hour and dinner. Thanks to the efforts of this year's meeting chair, Dr. Hill Craddock, Asheville's Highland Brewery provided a gift of IPA and Gaelic Ale. Cataloochee Guest Ranch owner and host, Judy Coker, made sure meals and evening activities were top-notch. The feeling of fall was in the air, since the ranch is nestled at 5000-ft elevation next to the Great Smoky Mountains National Park. Seventeen scientists discussed their work in Friday and Saturday sessions.

On Friday, the group travelled to the USDA Forest Service's Bent Creek Resistance Screening Center in Asheville, where Dr. Jared Westbrook and Ben Jarrett of TACF led

a tour of chestnut seedlings that are being screened for resistance to chestnut blight and *Phytophthora* root rot. Dr. Westbrook was able to present an analysis of blight resistance based on canker length that had been measured only two days before the meeting! The group next travelled to Edneyville, NC, where Dr. Paul Sisco of the Carolinas Chapter led a tour of the chapter seed orchard, showcasing Clapper-derived B₃F₂ trees that looked promising as candidates for blight resistance.

Next year the meeting will be in State College, PA, sponsored by Dr. John Carlson of The Pennsylvania State University.

From left to right beginning in the front row

1. Linda McGuigan, SUNY-ESF, Syracuse, NY
2. Didi Ren, Mississippi State University
3. Kirsten Hein, Univ. of TN at Chattanooga
4. Jared Westbrook, TACF
5. John Carlson, The Pennsylvania State Univ.
6. Cameron Stauder, West Virginia Univ.
7. Rita Costa, Forestry Research Station; INRB-Portugal
8. Hill Craddock, Univ. of TN at Chattanooga
9. Angus Dawe, Mississippi State University
10. Taylor Perkins, Univ. of TN at Chattanooga
11. Laurel Rodgers, Shenandoah University, Winchester, VA
12. David Morris, AL-TACF
13. Tatyana Zhebentyayeva, Clemson Univ.
14. Dakota Matthews, SUNY-ESF, Syracuse, NY
15. Ben Jarrett, TACF
16. Paul Sisco, CC-TACF
17. Fred Hebard, VA-TACF
18. Albert "Bert" Abbott, Univ. of KY and The Pennsylvania State Univ.
19. William MacDonald, West Virginia Univ.
20. Don Nuss, Univ. of MD, Emeritus
21. Steve Jeffers, Clemson Univ.



Dr. Paul Sisco (right) led a tour of the Carolinas Chapter seed orchard in Edneyville, NC. Photo by Linda McGuigan.



Dr. Bradley Hillman of Rutgers University, Administrator of the Regional Chestnut Project, holds the 2008 Award for Excellence in Multistate Research, given by the Northeastern Association of State Agriculture Experiment Station Directors. Pictured with Dr. Hillman are the official members of the regional project at the time the award was given. The photo was taken at the annual meeting of the regional project, which in 2008 was hosted by Dr. Dennis Fulbright of Michigan State University at the Chimney Corners Resort near Traverse City, MI.

PART 2

Part one of this three-part series described the biology of the fungus (*Cryphonectria parasitica*) that causes chestnut blight. Part two is focused on what occurs at the chromosomal level during traditional breeding methods used to create blight-resistant American chestnut trees. Most articles about traditional breeding methods to create blight resistant American chestnut trees oversimplify what happens and give the impression that the final generation consists of a population of highly-similar (or even identical) trees, all of which have exactly 6.75% DNA from Asian chestnuts and 93.25% DNA from American chestnuts. In fact, the traditional breeding process generates millions of genetic variants rather than genetically-identical clones. Part three will explain the technological advances in genetic engineering that are being used to insert genes that increase resistance to fungal infections into the chromosomes of wild-type American chestnut trees.

The American Chestnut Tree Returns

WITH SOME NEW PAIRS OF NEW GENES

By Kent Wilcox, Carolinas Chapter

Republished from the 2017 spring issue of *The Little River Watermark*, membership newsletter of Friends of DuPont Forest

All species of chestnut trees produce both male (**Figure 1**) and female (**Figure 2**) flowers on the same tree. However, pollen from a male chestnut flower cannot fertilize an egg produced by the same tree (see article by Dr. Paul Sisco in the March/April 2014 issue of *The Journal of the American Chestnut Foundation*). Surprisingly, pollen from one species of chestnut tree can fertilize an egg produced by any other species of chestnut tree. Trials as early as 1894 demonstrated that cross-pollination of female American chestnut flowers with pollen from either Japanese or Chinese chestnut trees produced fertile chestnuts (**Figure 3**). Traditional breeding begins by pollinating female flowers on wild-type American chestnut trees with pollen collected from male flowers on blight-resistant Asian chestnut trees (**Figure 4**).

Figure 1



Clusters of male chestnut flowers on long stalks called catkins. Courtesy of Timothy Van Vliet, Wikimedia Commons.

Figure 2



Female chestnut flower. Courtesy of Dr. J. Hill Craddock, University of Tennessee Chattanooga and Leah Florence and Forrest MacGregor.

Figure 3



Fruit of the American chestnut tree with three seeds. Courtesy of USDA Forest Service Southern Research Station, bugwood.org.

Figure 4



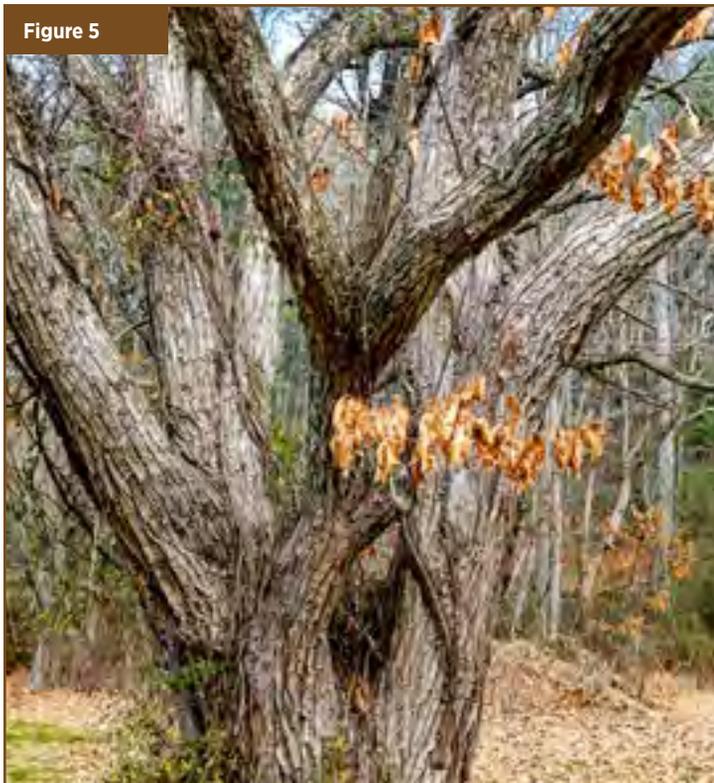
Hand pollination process by which a female flower is inoculated with yellow pollen grains collected in a cap. Courtesy of TACF.

In 1925, Russell Clapper and Flippo Gravatt at the US Department of Agriculture began to interbreed American chestnut trees (*Castanea dentata*) with the closely-related Japanese chestnut tree (*Castanea crenata*) or Chinese chestnut tree (*Castanea mollissima*), both of which tolerate infection by *C. parasitica*. Japanese and Chinese chestnut trees were imported to the United States as ornamental trees because they are shorter and more shrub-like in appearance (Figure 5) than the American chestnut, which grows straight and tall (Figure 6). Clapper and Gravatt and their successors Jesse Diller and Fred Berry worked for 35 years in the chestnut breeding program at the USDA, producing more than 10,000 hybrid trees. The USDA program was discontinued in 1960 because none of the hybrid trees met the desired criteria for blight-resistance and tree morphology.

In 1930, Arthur Graves, employed at the time by the Brooklyn Botanic Garden, began a personal crusade to create a blight-resistant hybrid chestnut tree on his farm in Connecticut. Over the next 30 years, he cultivated thousands of hybrid trees created from more than 250 different combinations of cross-breeding. Unfortunately, none of them exhibited both high resistance to blight and the tall, straight growth characteristics of the American chestnut. This failure was due in part to the assumption that the hybrid trees had to be predominantly Asian in order to retain high resistance to the blight.

In 1983, Charles Burnham, a plant geneticist from the University of Minnesota and Phillip Rutter, a Minnesota farmer with a strong interest in chestnut trees, gathered a group of plant scientists and concerned citizens at the

Figure 5



Chinese chestnut tree planted by the USDA more than 60 years ago in Holmes Educational State Forest, NC. Note that the main trunk divides into several large branches. Courtesy of Kent Wilcox.

Figure 6



Tallest living American chestnut tree in Maine. Courtesy of the University of Maine and TACF.

University of Minnesota to form The American Chestnut Foundation (TACF) with a mission to produce blight-resistant Asian/American hybrid chestnut trees. The method proposed by Dr. Burnham included a series of three sequential backcrosses in which Asian/American hybrid trees are interbred with wild-type American chestnut trees to increase the content of American DNA and reduce the content of Asian DNA (**Figure 7**). The final product is a tree in which approximately 94% of the DNA is derived from American chestnut chromosomes and 6% of the DNA is derived from Chinese or Japanese chestnut chromosomes. These amounts were chosen with the expectation that the hybrid trees would retain all of the Asian genes required to be resistant to the blight and all of the native genes required to produce tall, straight trees that resemble American chestnut trees.

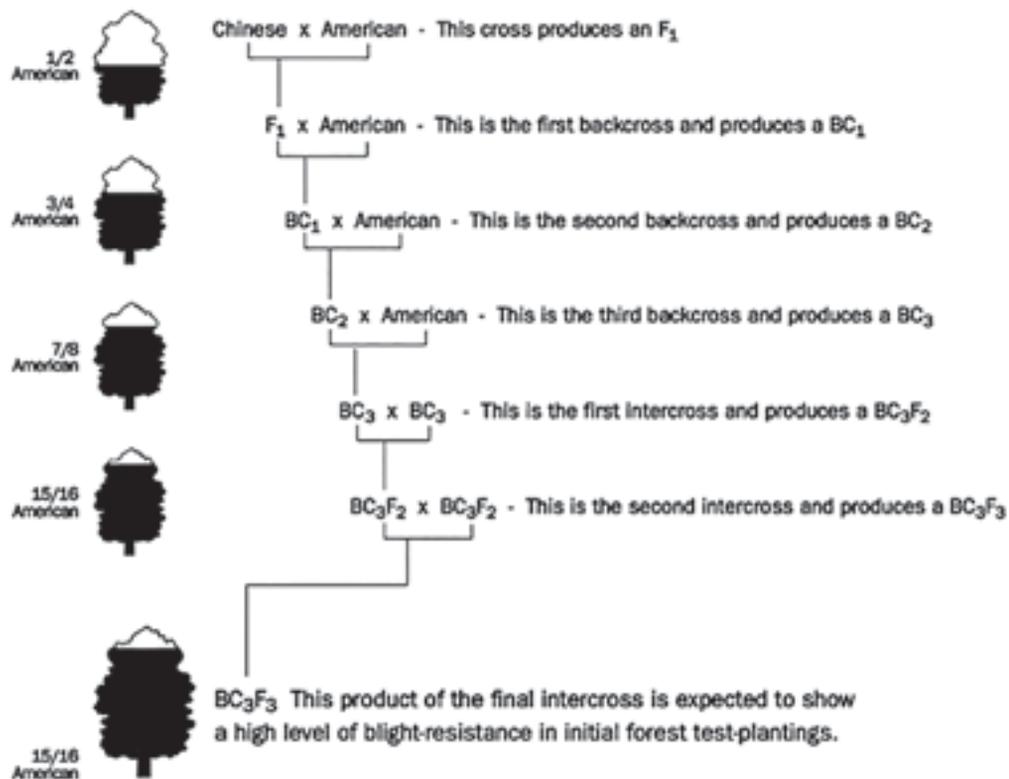
This proposal was a leap in faith because, in 1983, not much was known about what confers susceptibility or resistance to the fungus that causes blight. There was circumstantial evidence that genes on two or three different chromosomes in Asian chestnut trees are required for full blight resistance and there was experimental evidence that compounds produced by the inner bark of chestnut trees inhibit fungal infection. Until scientists better understand the mechanisms by which some species of chestnut trees resist initial infection and reduce or mitigate the toxic effects of on-going infections, traditional breeding methods will be essentially a hit-or-miss process in

which thousands of hybrid trees must be tested for the desired qualities. Since 1989, more than 125,000 hybrid trees have been planted on the TACF research farm in Meadowview, VA and tested for blight resistance.

The term resistance is often misinterpreted to mean that an infectious agent cannot reproduce in a resistant host, but it's not that simple. The ability of a plant to survive and thrive after an encounter with an infectious agent is defined by two terms – resistance and tolerance. Both terms have a range from low to high; for example, a tree could exhibit low resistance but high tolerance to an infectious agent. Resistance is a relative measure of how many infectious agents (spores, in the case of *C. parasitica*) are required to overcome defense mechanisms in a tree and initiate an active infection. Tolerance is a measure of how well a tree thrives during an active infection. Inoculation of Chinese and Japanese chestnut trees with a high dose of *C. parasitica* usually results in formation of cankers but not death; thus neither Chinese nor Japanese chestnut trees are fully resistant to fungal infection and both species are tolerant of infection.

The procedure for traditional breeding of chestnut trees uses pollen collected by hand from one tree (father or paternal tree) to hand-fertilize a female flower produced by another tree (mother or maternal tree). For a photo essay about the hand pollination process, visit this link on TACF's website: acf.org/nc-sc/photos/2005-pollinations/. For each interbred generation, the

Figure 7

Diagram of traditional breeding method to create BC_3F_3 hybrid trees. Courtesy of TACF.

mother tree is always a wild-type American chestnut to ensure that mitochondrial and chloroplast genes are derived entirely from the American chestnut

With the exception of germline cells (sperm and eggs), chestnut tree cells contain two nearly-identical sets of twelve chromosomes designated A through L. The paternally-derived set of twelve chromosomes is inherited via a sperm in pollen produced by the father tree and the maternally-derived set of twelve chromosomes is inherited via an egg in a flower produced by the mother tree. The hybrid chestnut produced after cross-pollinating an egg from an American chestnut tree with sperm from an Asian chestnut tree contains one set of twelve chromosomes from the American tree (maternal chromosomes) and one set of twelve chromosomes from the Asian tree (paternal chromosomes). A tree produced from this hybrid chestnut is called the F_1 generation (**Figure 7**). Because one set of 12 chromosomes in the F_1 chestnut is from the American parent and one set of 12 chromosomes is from the Asian parent, the F_1 generation is genetically 50% American chestnut and 50% Asian chestnut.

The good news is that F_1 chestnuts contain all of the genes required for resistance to *C. parasitica* and all of the genes required to form a tall, straight tree. The bad news is that F_1 chestnuts contain only one copy of each of the genes required for blight resistance (compared to two copies in the Asian chestnut), so the F_1 trees that grow from F_1

chestnuts are not fully resistant to the blight. The other bad news is that F_1 chestnuts contain all of the genes required to form a shorter, shrubby tree. Consequently, the F_1 trees don't look like American chestnut trees.

The next step in the breeding process, called the first backcross (BC_1), is designed to reduce the amount of Asian chestnut DNA and increase the amount of American chestnut DNA in the next generation, which is called the BC_1F_1 generation. The term "back" refers to the fact that the breeder goes back to the original maternal species to produce the next generation. When pollen from an F_1 tree is used to fertilize eggs from a wild-type American chestnut tree, the fertilized egg develops into fruit that contains BC_1F_1 chestnuts. The BC_1F_1 chestnuts contain 12 maternally-derived chromosomes that are 100% American DNA. The BC_1F_1 chestnuts also contain 12 paternally-derived chromosomes from the pollen produced by the F_1 tree, but the amount of Asian DNA in any given pollen grain varies, depending on events that occur when pollen is generated from specialized cells called microsporocytes.

Microsporocytes from F_1 trees contain 12 maternally-derived American chromosomes and 12 paternally-derived Asian chromosomes. Each microsporocyte undergoes meiosis to create four pollen grains. Each pollen grain contains two sperm and each sperm contains one copy each of chromosomes A through L. Each sperm in pollen produced by the F_1 tree gets one copy of chromosome A, but whether

that is the Asian or American version of chromosome A is purely random, so the odds that any given sperm will get the Asian version of chromosome A is 50%. The same thing applies to chromosomes B through L. All combinations are equally possible, so the 12 chromosomes that segregate into each sperm as the microsporocytes in the F_1 tree undergo meiosis could be all Asian or all American (well, not quite - see below) or some combination of each. There are more than 4,000 different combinations of twelve Asian or American chromosomes that could occur in sperm produced by F_1 microsporocytes, which is great news, because it means that using pollen from an F_1 tree to pollinate female flowers on wild-type American chestnut trees could result in more than 4,000 genetic variants.

It's actually a lot more complicated, because the Asian version of chromosome A in each F_1 microsporocyte swaps some DNA with the American version of chromosome A in each F_1 microsporocyte during meiosis (specifically during the prophase I step). The same thing happens with the Asian and American versions of chromosomes B through L. Consequently, each chromosome in sperm produced by F_1 trees is itself a hybrid of Asian and American DNA. This swapping of DNA greatly increases the genetic diversity of sperm produced by F_1 trees; rather than 4,000 genetic variants, there are millions of genetic variants among the sperm produced by each F_1 tree. My apologies for this detailed explanation, but it should dispel any notion that chestnut trees produced by traditional breeding methods are genetically identical (or clones). To better understand this complicated process, interested readers should watch an animated video about meiosis such as the one produced by McGraw-Hill entitled "Animation: How Meiosis Works." Pay particular attention to what happens during prophase I.

Although it is misleading to say that each sperm produced by an F_1 tree contains 50% American DNA and 50% Asian DNA, if one determined the average amount of Asian and American DNA in 100,000 sperm produced by F_1 trees, the collective average would be about 50% each. Taking the sum of both the maternally-derived (100% American) and paternally-derived (an average of 50% American and 50% Asia) DNAs, the BC_1F_1 chestnuts contain an overall average of 75% American DNA and 25% Asian DNA. Thanks to the varied amount of Asian DNA in the F_1 sperm, some BC_1F_1 nuts contain a lot more and some contain a lot less than 25% Asian DNA. Consequently, both the blight resistance and the growth form of the BC_1F_1 trees are highly variable. The only way to determine which trees contain the blight-resistance genes is to infect thousands of BC_1F_1 trees with *C. parasitica* and wait several months to see which trees do not develop large cankers.

After blight-resistant BC_1F_1 trees are identified, a second backcross (BC_2) is performed in which pollen taken from BC_1F_1 trees is used to pollinate eggs from wild-type American chestnuts. The fertilized eggs produce BC_2F_1 chestnuts. All of the maternally-derived DNA in the BC_2F_1 chestnuts is American and, on average, 75% of the paternally-derived DNA is American. Thus, on average, a total of 87.5% of the DNA in BC_2F_1 chestnuts is American and 12.5% of the DNA is Asian, but again, the actual amount of Asian DNA will vary quite a bit

from one chestnut to the next. Hopefully by now it is apparent that the third backcross (BC_3) produces BC_3F_1 chestnuts in which an average of 93.75% of the DNA is from American chestnut trees and 6.25% of the DNA is from Asian chestnut trees. Keep in mind that the figure of 6.25% is derived mathematically rather than genetically. The screening process used to select blight-resistant trees could skew the results towards a higher content of Asian DNA, whereas the screening process to select non-shrubby trees could skew the results towards a lower content of Asian DNA. In any case, because the twelve maternally-derived chromosomes in the BC_3F_1 chestnuts are 100% American DNA, the BC_3F_1 chestnuts contain, at most, only one copy (rather than a pair) of each of the Asian genes that confer blight resistance.

Assuming that a double dose of the Asian genes is required for full blight resistance, the next step in the breeding process is to inbreed the BC_3F_1 trees, which means that pollen from one BC_3F_1 tree with the desired characteristics is used to pollinate an egg produced by another BC_3F_1 tree with the desired characteristics. When a species is inbred, the second generation is called the F_2 generation, so chestnuts produced from the BC_3F_1 sperm x BC_3F_1 egg inbreeding are called BC_3F_2 chestnuts. The most important component of this inbreeding is that, in contrast to the eggs produced by wild-type American chestnuts, the eggs produced by the partially blight-resistant BC_3F_1 trees contain some Asian DNA, including one copy of some or all of the Asian genes required for blight resistance. Thus, for the first time in the breeding process, it is possible for both the paternally-derived and the maternally-derived DNA in the fertilized eggs to contain Asian genes that confer blight resistance. Consequently, some of the BC_3F_2 chestnuts should contain pairs of the genes required for blight resistance, but the only way to know for sure is to test trees grown from BC_3F_2 nuts. There are several genes required for full blight resistance, so to increase the probability that all of these genes are represented as pairs in the final hybrid trees, the last step in the breeding process is to inbreed BC_3F_2 trees with the desired characteristics to produce BC_3F_3 chestnuts. Some of these BC_3F_3 chestnuts should contain a double dose of most if not all of the Asian genes that confer high resistance to the fungus that causes chestnut blight.

Will these blight-resistant BC_3F_3 chestnut trees thrive in Appalachian forests? The only way to know is to plant thousands of the BC_3F_3 nuts in forests from Alabama to Maine and monitor their growth and survival over the next twenty years. Clearly traditional breeding is a long-term and highly laborious process that results in millions of genetic variants, most of which are ultimately discarded. There is growing excitement that advances in molecular genetics will provide a much more efficient and rapid method to create blight-resistant American chestnut trees. The last article in this series will address that possibility.

Dennis Fulbright:

HOW THE LOVE OF A ONE TREE CAN INSPIRE ONE PERSON

By Emily Nowels

The idea of roasting chestnuts tends to evoke a sense of nostalgia – a scene from an old Christmas movie you watched as a child. But Dennis Fulbright, Michigan State University’s professor emeritus in the Department of Plant, Soil and Microbial Sciences and former TACF board member, is hoping to make roasting chestnuts a present-day indulgence rather than a rare, sentimental nod to the past.

Fulbright works with farmers in Michigan to create a thriving chestnut crop. Although he currently works with the European chestnut, he spent many years studying the American species. Furthermore, by merging the more blight-resistant European chestnut, with research on hypovirulence, Fulbright is demonstrating a two-tier method of fighting blight that parallels a potential approach for reintroducing American chestnuts.

“A disease is the result of a triangle. So you have your host which would be the American chestnut; the pathogen, which is the chestnut blight; and then your environment,” Fulbright said.



Dennis Fulbright in his plant pathology laboratory at Michigan State University looking over some cultures of the chestnut blight fungus, *Cryphonectria parasitica*.

Fulbright started working at Michigan State University as a wheat pathologist, and while he never stopped studying wheat diseases, the American chestnut quickly became his passion project. He got involved with chestnut research after a few colleagues told him about some very unusual Michigan chestnut trees.

These Michigan trees were brought to the area, probably by farmers, more than 100 years ago. What made these trees so unique was that many appeared to be naturally recovering from the chestnut blight.

By this time, European chestnuts were beginning to make a comeback throughout Europe due to the phenomenon of hypovirulence, which refers to a virus that weakens the chestnut blight, allowing the chestnut tree to fight off the aggressive fungus. So Fulbright began research in the hopes of identifying a native North American hypo-virus similar to the European hypo-virus that was proving to be so effective abroad.

However, the hypovirulence that they found in these trees was markedly different than the one in Europe.

“Some people didn’t even think that’s what it was at first because it was so different,” Fulbright said. “So we had a lot of convincing to do.”

Then Fulbright and his research group made a discovery which Fulbright described as the type of thing you boast about finding

“when you’re old and retired and sitting in your den at home.”

They found a hypovirulent strain of chestnut blight that did not have a virus.

“And that completely flipped everything. Because it used to be if you wanted to see if it had hypovirulence, you would isolate the virus, and if the virus was there you knew it was probably hypovirulent. But all of a sudden there was no virus,” Fulbright said. “And not only that but it was transmissible. But if you don’t have a virus, what’s moving? So that was a good ten-year project.”

Eventually, they found a mutation in the chestnut blight’s mitochondrion that made the strain hypovirulent. The function of the disease was similar to what was happening with the virus, however it was due to mutations occurring with the fungus itself.

“[This mutation] is not what we use today, but it was a great research project because it tells us that there are a lot of constraints to these fungi—even successful pathogens like chestnut blight, which is probably the most successful tree pathogen in the world,” Fulbright said. “It has viruses; it has a self-illness. So it’s not an easy life for the chestnut fungus any more than it is for the tree or for any other organism on the planet.”

Then in the early 90s, Fulbright was invited to investigate a stand of trees in West Salem, Wisconsin. These

trees had escaped the blight for years, but had eventually succumbed to the fungus. Initially, efforts to save the stand consisted of removing any blight-ridden trees; however, these attempts proved unsuccessful. At this point, Wisconsin scientists reached out to The American Chestnut Foundation (TACF) and were directed to Fulbright.

Fulbright’s main objective in Wisconsin was to take what was already occurring naturally in the Michigan stands of trees and bring that resistance to Wisconsin. They did this by applying the hypovirulent fungus from Michigan the cankers on the Wisconsin infected trees.

“You know you never feel so insignificant as when you’re standing next to a tree with a 24-inch diameter and you look up at it, 70 feet above you, and you have this little bottle of goo,” Fulbright said laughing. “And you think, ‘okay where do we start?’”

They started near the center of the stand and every year Fulbright would gather a team from Michigan to travel with him to Wisconsin. Through this project Fulbright says he began to see some of the limits of hypovirulence. He began noticing that between two adjacent trees, roughly the same size, treated at the same time, one might go into recovery while the other would succumb to the fungus.

“A disease is the result of a triangle. So you have your host which would be the American chestnut; the pathogen, which is the chestnut blight; and



Dennis Fulbright helps with the chestnut harvest in a Michigan chestnut orchard.



(l-r) Josh Springer, Dennis Fulbright and Carmen Medina Mora help set up orchards in Michigan for nut production. Their company, Chestnut Orchard Solutions, was originally founded to provide information on chestnut blight management, but they quickly found other needs in the orchards.

then your environment,” Fulbright said. He explained that depending on a scientist’s specific background, they tend to research one corner of the triangle more than another.

As a pathologist, he had always been interested in the blight; however, over time he became more interested in the tree. In the areas of Wisconsin where Fulbright and others had worked hardest, they were seeing only a roughly 50 percent recovery rate. This led Fulbright to return to the stands in Michigan and look at the success of control there.

While many trees were certainly recovering, he began noticing others were still dying.

“When you walk into an American chestnut stand that is recovering, you are so in awe of it that you don’t look at the dead ones. You look at the living ones—count the living ones,” Fulbright

said. “You think, my gosh, there is a chestnut canopy over my head; there are chestnut leaves on the ground; there are seedlings everywhere. You start to look at only the positive aspects because you know what is normal—the negative aspects.”

This eventually led Fulbright to where he is today, helping local Michigan farmers create chestnut orchards. They are currently using European chestnuts and treating them with hypovirulence when they become infected. This model of combining a more blight-resistant tree with hypovirulence is where Fulbright believes the future is for the American chestnut—in merging hypovirulence with the TACF backcross program.

“It’s time to merge the pathologists and the geneticists.[...] Go back to that triangle,” Fulbright says. “Maybe we can enhance

the resistance and decrease the aggressiveness of the pathogen with hypovirulence. Now we have two of our corners working together.”

More and more, this approach seems to be the one that others are finding most promising as well. Fulbright has dedicated much of his life’s work to researching the American chestnut, but says that this passion extends to the species as a whole.

“I fell in love with American chestnut first, but then fell in love with the entire genus *Castanea* as I got older. I’ve seen *Castanea* growing around the world, and I cannot think of a better tree than the chestnut,” Fulbright said. “If you had to build a tree from scratch you’d build the chestnut tree. And keeping that tree healthy and alive should be a goal of humankind.”

TACF’s Pure American Program

Beginning this February, The American Chestnut Foundation will once again be selling pure American seedlings in bundles of 10, 25, and 50. Purchases can be made online and membership is not required to buy the seedlings. However, if you’d like to become a member of TACF and support our mission to return the iconic chestnut to its native range, please click the “Membership” button on the store page.

Growing pure American chestnut trees is a wonderful learning experience. Some will survive many years and may produce seeds. However, the trees will eventually become infected by the blight fungus and some may not survive.

This is a very popular program and the seedlings sell out quickly.

Distribution range is limited to states east of the Mississippi (no exceptions).

PRICING FOR PURE AMERICAN SEEDLINGS

Only sold in quantities of 10, 25, 50; shipping included
Shipped by FedEx (no PO Box delivery, street address only)

10 seedlings - \$65.00

25 seedlings - \$150.00

50 seedlings - \$250.00

**Order between February 1 and March 31 (while supplies last) on our website at acf.org.
Click the “Pure American Seedlings” button to place your order.**

1891

Chestnut Circular

Have you ever wondered about the economic contribution of the American chestnut in our Nation's history? If so, you'll want to see this! We have been given an extraordinary and rare glimpse into that history, thanks to TACF Virginia Chapter member, Dr. J. David Aller.

Dr. Aller, member and supporter of TACF since 1992, was presented with an original Chestnut Circular from New York, 1891 by a longtime friend and local artifact dealer who found it in an old trunk purchased from an estate in Heards, VA.

As reported in the circular, produce dealer and distributor Stephen H. Hayt revered his chestnut business as "unequaled." His two-month sales of \$271,527.75 in the fall of 1890 equates to approximately \$7,037,182.83 in sales today, of American "Northern and Southern chestnuts!"

Recently retired from a busy internal medicine practice in Charlottesville, Dr. Aller has been interested in the American chestnut and its restoration for many years and has worked to keep the story alive with younger generations. "I retell the story – over and over – to keep people aware and engaged!"

Dr. Aller has generously donated the framed circular to TACF and it will hang in our National office in Asheville, NC.

CHESTNUT C

For the Fall

CHESTNUT SALES, For the Fall of 1890.	MY BOOKS ARE OPEN.
Sales for the week ending	Notice the sum total of o Season's business.
September 27th.....\$9,360.71	
October 4th.....17,451.22	
" 11th.....41,313.50	I invite an investigation.
" 18th.....53,718.21	
" 25th.....44,319.22	I have the outlet. Do y want to put your goo where they will be b cared for?
November 1st.....27,518.96	
" 8th.....19,417.48	
" 15th.....21,817.48	
" 22d.....11,817.49	
" 29th.....13,901.33	All goods receive my p sonal supervision.
Two months' sales.....\$271,527.75	

GENTLEMEN:—For many years past I have been receiving Chestnuts. I have been for several years, the largest receiver and dealer in New York. My salesmen are thoroughly acquainted with all the best buyers in and out of the State. From letters received from the different producing sections, I have pressed on the minds of all shippers the necessity of getting the *early part* of the season as to realize the high prices that prevail at the early part of the season.

I cannot now tell what the market price will be, but judging from the prices of the *early part* of the season, they will be higher than they have been for several years. The best way is to ship all Chestnuts by express at the earliest possible moment they have for striking a high market. Your nearest railroad or express company will advise you.

Don't hold your Chestnuts, but ship at the earliest possible moment and the dealers want them Fresh and Green. I will keep you fully and completely supplied as the Chestnut season opens in New York. I inclose a few Tags, with which My Commission is Five per cent. I also handle Poultry, Game, Genies, etc. For any further information, prices, etc., write me, and I will give you the same.

Roasted Butternut Squash and Chestnut Soup

Recipe courtesy of Lynne Webb at MyGourmetConnection.com



Prep Time: 15 minutes
Cook Time: 45 minutes
Total Time: 1 hour
Yield: 6 servings

Ingredients

1 medium butternut squash (about 2-1/2 lbs)
 3 tablespoons butter
 3 shallots, very finely chopped
 12 chestnuts, roasted, peeled and finely chopped
 1/2 teaspoon salt
 1/4 teaspoon black pepper

1-1/4 cups fresh apple cider
 2-1/4 cups chicken broth
 1/4 cup heavy cream (or more to taste)
 1/4 teaspoon ground nutmeg
 White truffle oil for drizzling (optional - see notes)
 Fresh thyme leaves for garnish

Instructions

- 1 Preheat the oven to 375°F. Scrub the butternut squash and cut in half lengthwise. Scoop out the seeds and brush the cut surface with vegetable oil. Place, cut side down on a shallow baking pan that's been sprayed with nonstick spray. Bake for 25 to 35 minutes, until the squash appears wrinkled and is very tender when pierced with a knife. Allow to cool slightly.
- 2 While the squash cools, melt the butter in a 4-quart saucepan over medium heat. Add the shallots and sauté just until softened, 1 minute. Add the chestnuts, salt and pepper and continue cooking, stirring frequently, 2 minutes longer. Do not brown the mixture. Stir in the apple cider and bring to a simmer.
- 3 Scoop the butternut squash from its skin and add it to the simmering cider. Using a spatula or large spoon, mash the squash as best you can, then add chicken broth. Bring the soup back to a simmer and cook for about 5 minutes longer.
- 4 Using a hand-held blender, purée the soup directly in the pan, or, blend in several batches in a conventional blender and return to the pan. Stir in the cream and nutmeg and heat through, 1 minute.
- 5 To serve, ladle the soup into serving bowls, drizzle with truffle oil if desired and garnish with a sprinkling of thyme leaves.

Recipe Notes: A good quality walnut oil could be substituted for the truffle oil if desired. The flavor will be different, but it will still pair nicely with the soup. Of course, you can omit the oil altogether if you prefer.

IN MEMORY AND IN HONOR

of our TACF Members

AUGUST 25, 2017 - DECEMBER 31, 2017

IN MEMORY

- Jerry Abernathy**
From: Kathy and Fred Bullmer
- Nathan Ackerman**
From: Glenn Ackerman
- Emily Hammond Bellows**
From: Alfred Bellows
- Howard "Lee" Bowers**
From: Gerald Bowers
- James Ely Bradfield**
From: John and Amy Bradfield
- Ralph and Jessie Campbell**
From: Carolyn Howes Keiffer and Philip Tinne
- Chestnut Tree Hill**
From: Sandra Tarbox
- James Edward Dunn**
From: Laura Hanley
- Robert Evans**
From: Betty Seidel
- Alexander Federowicz**
From: Yvonne Federowicz
- George A. Graham**
From: Knox Family Foundation
- Albert C. Hoffert**
From: Mary K. Baker
James Balshi
Madeline Bingell
Diana Bonaskiewich
Jeanette Boos
Joan Brosious
Jo Ann Casciano
Elaine Cooper
Eleanor Delfoe
Doris Diehl
David Donchetz
Richard Eckert
Brenda Gates
Richard Geyer
Clifford Glezen
Hellertown Sportsmen Association
Roberta Hoffert
David and Debra Joseph
Barry Judd
Elaine D. Lipp
Lois Prosser
- Susan Raab**
Stephen Roseman
Anita Rothenberger
Dorothy Seeds
Kenneth and Nancy Sutton
Donna Szczepanski
Addison Unangst
Richard H. Woodring
Fran Zamiski
- John and Bernice Hoffman**
From: Steve and Catherine Palmateer
- Paul O. Howard**
From: Berry Howard and Robin Canady
- Wylie Pierson Johnson**
From: Melanie Fay Johnson
- Push LaGrone**
From: The Boston Family
- Robert Gregory Mallon**
From: George Harris
Katherine Johnson
Gina Mallon
William Mallon
Michael McCulley
Paul Yudd
- Ellen Ottaway**
From: Ann Logue
- Ann Marie Morris Patterson**
From: David Morris
- William Payne**
From: Jacqueline Payne
- Joseph H. Pinchbeck**
From: Joseph Pinchbeck
- Dr. Thomas J. Plona**
From: Vincent Plona, Jr.
- Frederick Alan Saal**
From: Claire Saal
- Grady H. Simmons, Sr.**
From: Dr. and Mrs. Charles W. Houghton
- Charles B. Talbert**
From: Karen Talbert

IN HONOR

- Lorraine C. Backer**
From: Donald Backer
- Susan Barber and Gordan Millsaps**
From: Gerald Staninger
- Rodney Byam**
From: Linda Byam
- Bruce Crawford**
From: Sybil Crawford
- Hartwell Davis, Jr.**
From: Mary Holdeman
- Karen Davis and Allen Schnack**
From: Ellen Petti
- Michael Doochin**
From: Edwin Bass
- Sharon Eaton**
From: Adele Gillis
- John Evangelakos**
From: Alan Sinsheimer
- Craig Falls**
From: Kay Cromwell
- Robert Fogelsonger**
From: David Mosher
- Richard Frase**
From: Mary Frase
- Peter A. Gale**
From: Jennifer Long
- Cody George**
From: Emily Perse
- Michael Gold**
From: Hannah Gold
- Goodwin Trees**
From: Linda O'Gorman
- Michael D. Hagen, M.D.**
From: Gwendel C. Hagen
Michael Hagen
- Deborah Harrison and Cheryl Morenz**
From: Joanne Siegrist
- Lois Hindhede**
From: Neil Hindhede
- Jane Isbey**
From: Dr. Edward Isbey III
- Brian Jayne**
From: Rebecca Jayne
- Robert Kilpatrick**
From: Edith Kilpatrick
- Eric and Bri Lagueruela**
From: Debra Lagueruela
- Dr. Max V. McLaughlin**
From: Anne McLaughlin
- Nina Budabin McQuown**
From: Kathleen McQuown
- Judith Collins Millar**
From: Elizabeth Gullely
- Janelle Reardon**
From: Fairview Park Garden Club
- Ruffner Mountain, Birmingham, AL**
From: Paul Hoffman
- Chris Schlegel**
From: Howard Schlegel
- David Schlegel**
From: Howard Schlegel
- Eric Schlegel**
From: Howard Schlegel
- Jane Schlegel**
From: Howard Schlegel
- William Schlegel**
From: Howard Schlegel
- Sallie Smith**
From: Joy Shaver
- Don Switzer**
From: Herbert Ley
- Patsy Taylor**
From: Anne Taylor
- Cookie Teer**
From: Peter Kaufman
- Karen and Doug Terry**
From: Laurie Terry
- Tommie and Wes Waters**
From: Elizabeth Gamble and Peter Lichstein
- Emily Watson**
From: Abingdon Garden Club



THE
AMERICAN
CHESTNUT
FOUNDATION®

50 N. Merrimon Avenue
Suite 115
Asheville, NC 28804



TACF'S 35TH ANNIVERSARY CELEBRATION AND ANNUAL MEETING

October 26-28, 2018

Join us for a special annual meeting
celebrating 35 years
of tireless commitment to restore the
iconic American chestnut tree.

The meeting will take place in Huntsville, AL, also known as Rocket City because of its rich history in aerospace and military technology.

This year's agenda will include education and poster sessions, fantastic keynote speakers, the awards dinner, as well as a visit to TACF's chestnut orchard at Redstone Arsenal.

Look for additional details this summer in our *eSprout* electronic monthly newsletters and on our Facebook and Twitter pages.

facebook.com/americanchestnut • [twitter/chestnut1904](https://twitter.com/chestnut1904)

